the tree species involved, the processes of manufacture, the marketing, the utilization, and values are discussed. Whenever any attempts have been made toward standard specifications and grading of the products, these are given in considerable detail. Statistics of production in the United States or of importation from other lands are arranged in convenient tables, and still more important for the scientist is the bibliography which is appended to each chapter. Costs of raw material, labor, overhead, and marketing are considered, as well as selling prices and total value of production; while a detailed index makes this mass of information available for ready reference.—GEO. D. FULLER.

Economic woods

RECORD'S[5] presentation of the subject of wood structure has already made his book, in its first edition, indispensable in all laboratories where the identification of wood is attempted, on the basis of its structure as revealed through the microscope. The volume has also proved equally useful in classes where the general principles of wood structure are being studied, hence an enlarged second edition will be welcomed by a considerable constituency.

Among the desirable features of the work are good clear illustrations (whose number might be increased to advantage), logical organization, concise statement, convenient tables for reference, and a well arranged, excellent bibliography, which in the present edition is brought down to 1918. The identification key has been revised and improved and appears adequate to the demands likely to be made upon it.

One of the features of the new edition is an appendix devoted to a general description of the woods of the United States and their classification on a structural basis. Tables giving the occurrence of such structures as pits, spiral markings, and tyloses in various genera and species afford convenient means of classification and of easy reference.—GEO. D. FULLER.

NOTES FOR STUDENTS

Influence of a crop on succeeding one.—HARTWELL and his associates[6] have done some very important work on the influence of crop plants on those which follow. Some crops are very injurious to those which follow them, while other successions reveal no injurious action. As is shown by an illustration on the front cover of Bulletin 175, buckwheat is greatly injured when it follows millet, but shows good development when it follows turnips. The method,

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[5] RECORD, S. J., Identification of the economic woods of the United States. 8vo. pp. 157. *pls. 6. figs. 15.* New York: Wiley & Sons. 1919. $1.75.

[6] HARTWELL, B. L., and DAMON, S. C., The influence of crop plants on those which follow. Bull. 175. Agric. Exp. Sta. R.I. State College. 1918.

HARTWELL, B. L., PEMBER, F. R., and MERKLE, G. E., The influence of crop plants on those which follow. Bull. 176. Agric. Exp. Sta. R.I. State College. 1919.

results, and significance of these experiments can best be presented by quotations from the summaries of the two bulletins:

"The general plan of the field experiment, which is the main subject of this bulletin, is to grow 16 different crops on that number of plats for two seasons prior to growing a different one of the crops over the entire area every third year. No farm manures are used, but fertilizer chemicals are applied on all plats alike, in amounts intended to supply an average of the nutrient needs of the different crops. Information regarding these needs is obtained by soil tests conducted in pots at the greenhouse and in sections of drainpipe sunk in the paths between the field plats.

"Onions occupied the entire area in 1910. If the preceding crops are arranged in the order of increasing yields of onions of the first class, it is seen that 13–17 bushels of onions per acre were produced following cabbages, mangel beets, rutabaga turnips, and buckwheat; 35 and 87 bushels following potatoes and rye; 131–178 bushels following corn, millet, onions, oats, and red clover; 240–314 bushels following squash, timothy, and alsike clover; and 406 and 412 bushels following mixed timothy and redtop, and redtop alone.

"In 1913, after the miscellaneous crops had been grown on their respective plats again for two years, buckwheat was planted on the entire area. Again arranging the crops in accordance with increasing yields, it follows that only 4–10 bushels of buckwheat grain were produced where millet, grasses, corn, and clovers had been growing previously; 13–15 bushels where buckwheat and oats were the preceding crops; 20–23 bushels where the preceding crops had been cabbage, beets, onions, rye, squashes, and potatoes; and 34 bushels following turnips.

"Alsike clover was chosen for the crop next grown on the entire area. The lowest total yields of clover hay for the two years 1916 and 1917 were 2.53–2.60 tons per acre, following the clovers and carrots. The highest yields were 4.16–4.33 tons, following rye and redtop, and two years' failure of squashes. Intermediate yields of 3.31–3.86 tons were secured following the remaining crop plants.

"The divergent effect of crops on those which follow seems not to be attributable, at least principally, to differences in the amount of nutrients removed by the crops grown previously; that is, the smallest yield may not occur after the crop which removed the largest amount of even the most-needed nutrient. The soil acidity was affected differently by the several crops and, generally, the best yields of the onion, a plant which is sensitive to conditions accompanying acidity, followed the crops giving rise to the least acidity. These indications assume added importance because of the observed fact that the effects of the crops on those which follow were much less divergent if the soil acidity was reduced by liming.

"Even if later work should prove that preceding crop effects are not important in connection with a neutralized soil, attention should nevertheless be given by the practical farmer to the very potent influences which have been

observed in the present work, for the reason that so many soils have a greater degree of acidity than existed in these experiments, and it is doubtful if they will ever be limed sufficiently to maintain them in a neutral condition."

This work should be of great interest to the ecologist and the physiologist, as well as to the agriculturist.—WM. CROCKER.

Upper Cretaceous floras.—The eastern gulf region in Tennessee, Alabama, and Georgia, discussed by BERRY[7] with reference to the Upper Cretaceous floras, includes that part of the Atlantic coastal plain bordering on the Gulf of Mexico and lying south and west of the southern Appalachian province and east of the Mississippi River. An excellent map in colors shows the exact geographic location of the different geological formations which contain determinable plant fossils, and it appears that the bulk of the fossil floras belong to the Tuscaloosa formation, with those of the Eutaw and Ripley floras meagerly represented.

The author gives a systematic arrangement of the plants found in the Upper Cretaceous of the Gulf region, with a historical sketch, an account of the lithologic characters of the materials associated with the fossils, and a discussion of the localities with plant remains. Photographs and diagrammatic sections help to elucidate the account arranged according to the different localities where plant fossils have been found. After a thorough analysis of the field observations made separately for the Eutaw, Ripley, and Tuscaloosa formations, the composition, origin, and evolution of these different Upper Cretaceous floras follow. The 151 described species from the Tuscaloosa formation represent 87 genera segregated into 48 families. The pteridophytes are represented meagerly, while the cycad-like plants, abundant in the Lower Cretaceous, are represented by a single species of *Podozamites* and *Cycadinocàrpus*. Sixteen species of Coniferales of modern types, as *Pinus*, *Dammara*, *Sequoia*, occur with the curious extinct phylloclad type, *Andcovettia*, etc. The angiosperms constitute the bulk of the Tuscaloosa flora. The author explains the scarcity of the monocotyledons as largely due to the fact that the lack of differentiation of the leaf lamina and petiole precludes the regular shedding of their leaves, which are torn to shreds by the wind, and therefore unrecognizable. The dicotyledons of the Upper Cretaceous are of great interest as to their origin, for they appeared with great suddenness at the close of the Lower Cretaceous in America, Europe, and the Arctic region. The author believes that North America was near their center of radiation, with the facts in accord with their Arctic origin and with successive waves of migration sweeping southward.

Dealing specifically with the Tuscaloosa formation, BERRY emphasizes its delta character with its flora of a lowland coastal type, including a number of distinctly strand types, such as the species of *Murica*, the figs, and several

[7] BERRY, E. W., Upper Cretaceous floras of the eastern gulf region in Tennessee, Mississippi, Alabama, and Georgia. U.S. Geol. Survey, Professional Paper no. 112. pp. 117. *pls. 1–33*. 1919.